Fueling the Future

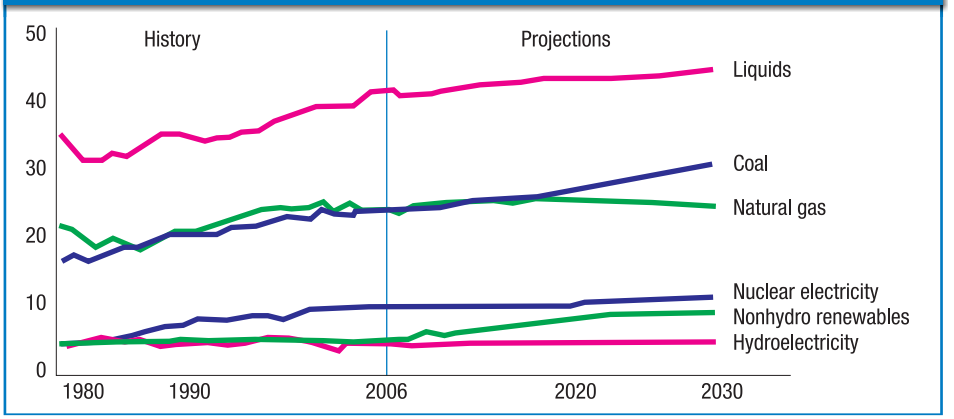
The U.S. Department of Energy's Office of Nuclear Energy

Expanding Markets for Nuclear Energy Beyond the Grid

The United States must expand and diversify its energy portfolio in an environmentally sound and secure manner to enable economic growth.

A diverse mix of energy sources has enabled the United States (U.S.) to meet its energy demands while balancing costs, availability and impacts. The U.S. current electrical energy supply comes from a mix of fuels with the majority being produced by coal (50%) and nuclear (20%). Natural gas, hydroelectric, and renewables such as solar and wind power complete the U.S. energy portfolio. However, U.S. industries are now confronted with the increasing costs and volatility of fossil fuels and their associated carbon-release impacts. These fossil fuels not only produce electricity, but they are used to produce heat and feedstock for a number of industrial applications and products. Nuclear energy is unique in that it can provide a safe, reliable and affordable source of energy that industry requires to maintain competitiveness and to sustain productivity while being less susceptible to volatility in fuel costs, disruptions in fuel supplies, environmental impacts, and potential carbon taxes.

Energy Consumption by Fuel 1980-2030



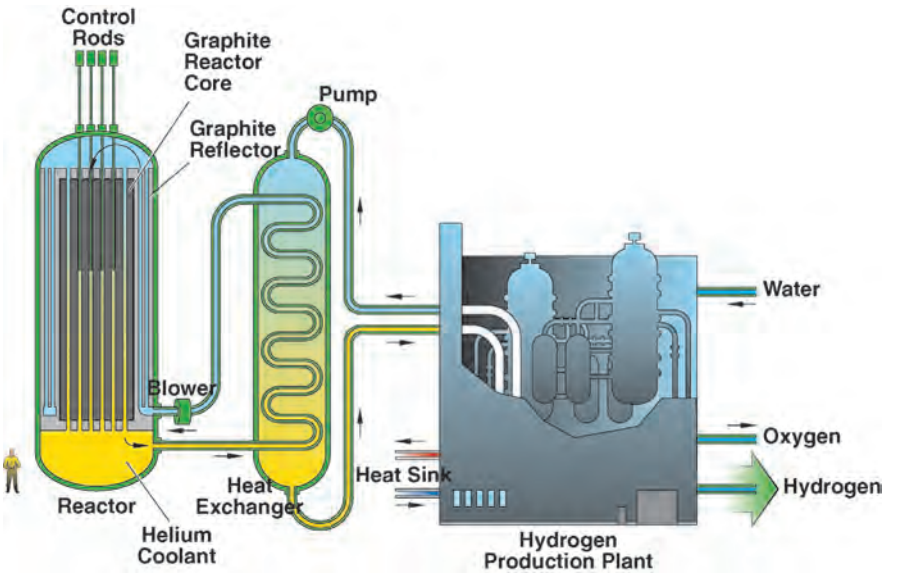
Source: www.eia.doe.gov/oiaf/aeo/overview.html

Nuclear reactor technology is not new. Currently, there are 104 commercial light-water reactors (LWRs) operating at over a 90% capacity factor. Applications for safer and more effective LWR designs have been approved or are under review by the Nuclear Regulatory Commission. These newer LWR designs are under consideration for over 30 nuclear power plants throughout the U.S.

Nuclear energy is unique and flexible - it can be coupled with other energy sources such as fossil-fuel (coal/natural gas) and/or renewables (wind/solar) to produce electricity, process heat, and products. Combining these programs into a hybrid energy system will enable U. S. industries to competitively produce liquid transportation fuels (gasoline, diesel, and synthetic fuels), petrochemicals (ammonia and methanol), and hydrogen. The commercial and military aviation industry are promising early markets which can benefit from increased production of synthetic fuels. Small modular reactors, or the larger LWRs and/or future advanced reactors can be integrated into the existing infrastructure of commercial industry to replace fossil fuels (natural gas/coal) as the primary source of process energy needed for the production of synthetic fuels and petrochemicals. This would allow the fossil fuels to be used as additional feedstock in the production of much higher valued liquid fuels. This synergistic approach would bring together the right energy source to meet the needs of the U.S. - either high temperature process heat for industrial applications or the production of additional electricity for the grid.

On a parallel path, new nuclear technologies such as the High Temperature Reactor (HTR) will continue to advance to meet future energy demands and support higher-temperature processes. The HTR will provide higher temperature process heat to commercial industrial applications that require up to 950° C, exceeding the current LWR design output which operates at approximately 300° C. These higher temperatures will provide industry with additional process optimization opportunities for hydrogen and other products such as fertilizers, plastics and methanol that were either limited by the lower temperatures of the LWR, or the higher costs of fossil fuels. The HTR will be able to support the petroleum industry with oil refining operations, tertiary oil recovery in existing oil fields, in-situ recovery of petroleum from tar sands, and future in-situ exploration of oil shale deposits. Natural gas is currently used as the primary heat source for all three operations.

High Temperature Reactor (HTR)



The Vision—Hybrid Energy Systems Built into Strategic Energy Parks